A Sealed Optical Cell for the Study of the Lithium Electrode/Electrolyte Interface

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The development of practical high energy density rechargeable batteries is commercially attractive for use with portable applications such as laptops, camcorders and mobile phones. Furthermore, from an environmental perspective, batteries of this type will enhance our ability to utilise renewable resources such as solar power.

The use of a lithium metal electrode represents a significant improvement in specific capacity over the graphitic carbon electrode that is typically used in lithium ion batteries. The realisation of a practical lithium metal rechargeable battery is prevented by issues which arise from the poor reversibility of the lithium deposition/dissolution process.

It has been demonstrated that the cycleability of the lithium metal electrode can be affected by the composition of the electrolyte, electrolyte additives, current density, stack pressure and the use of polymer electrolytes.

This paper describes the fabrication of a sealed Li symmetrical cell (Fig. 1) and apparatus (Fig 2), which can be used to for optical observation of the lithium electrode/electrolyte interface during cycling (Fig 3). The cell is similar in configuration to the cells used by Brissot et al.[1] The images obtained allow the observation of the evolution of the lithium deposit morphology as the cell is cycled. The images provide a qualitative assessment of the efficiency of the lithium deposition/dissolution process.

The cells are relatively simple to make and are reproducible in terms of electrode surface area, electrode spacing and electrolyte volume. The cells can be used in conjunction with electrochemical and spectroscopic techniques to evaluate the effect and relative success of strategies to enhance the cycleability of the lithium metal electrode.

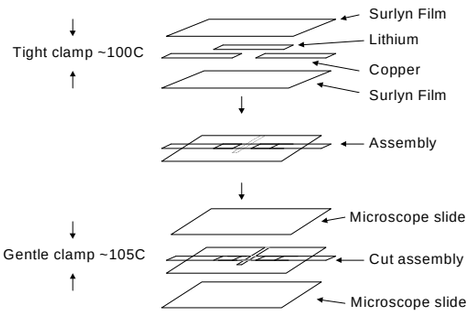

Fig. 1 Fabrication of the sealed lithium symmetrical cell.

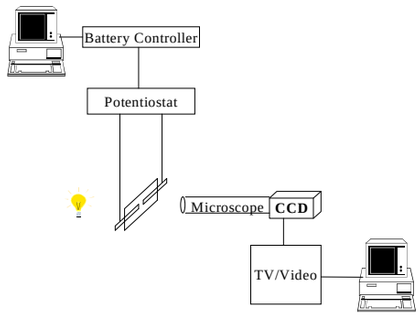

Fig. 2 Apparatus for the observation of the lithium electrode/electrolyte interface.

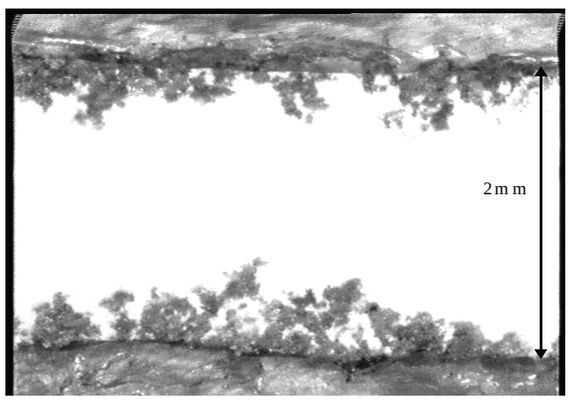

Fig. 3 Optical cell image of the lithium electrode in 1M $LiPF_6$/PC 100 cycles (2 mA/cm^2 and 1 C/cm^2)

REFERENCES

1. C. Brissot, M. Rosso, J.-N. Chazalviel, and S. Lascaud, *Journal of Power Sources*, **81**, 925 (1999).